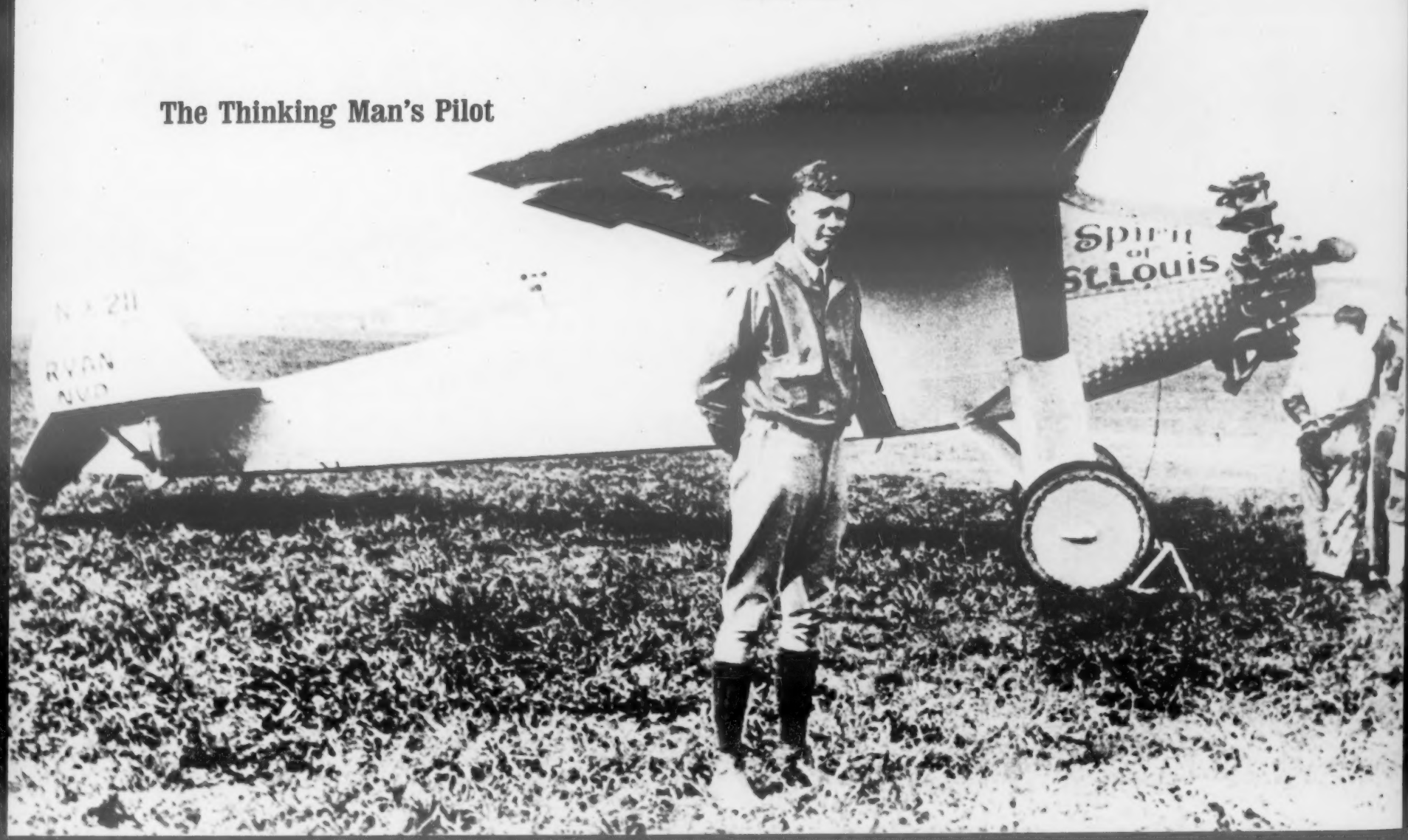
FAA GENERAL AVIATION NEWS

JUNE 1977

A FLIGHT STANDARDS SAFETY PUBLICATION FOR AIRMEN

The Thinking Man's Pilot



FAA GENERAL AVIATION NEWS

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Upside Down

The attitude of the pilot as well as the aircraft is the key to safety in aerobatic flight

The occupants of the Cessna *Aerobat* were a married couple, both with commercial pilot certificates. The husband, who was in the lefthand seat, had logged over 2,000 hours, and had instrument and multiengine ratings. Most of his air time was accumulated in his company's light twin, on business flights. He had recently started on a ten-hour course described as "Basic Aerobatic Flying," given in the *Aerobat* by a certificated flight instructor with considerable experience in aerobatics. The company pilot was an enthusiastic student and spoke frequently to fellow pilots of the additional skill and confidence in the cockpit he felt he was acquiring as a result of the training, and he urged others, including his wife, to take the course. He had completed seven hours of the course before he took his wife up to show her some of the maneuvers he had learned.

On the afternoon of the flight he signed out the aircraft and two parachutes at 4:00 p.m., conducted what appeared to be a routine preflight, took off with his wife and flew directly to the practice area, about ten miles south of the airport. Three independent witnesses reported seeing the aircraft, identified by the checkered tail, complete a series of wingovers at an altitude of approximately 3,500 feet. Then a spin series to the left was initiated. One witness, a certificated pilot, counted seven turns before the aircraft disappeared behind a line of trees and crashed into the adjoining field. Both occupants were killed on impact.

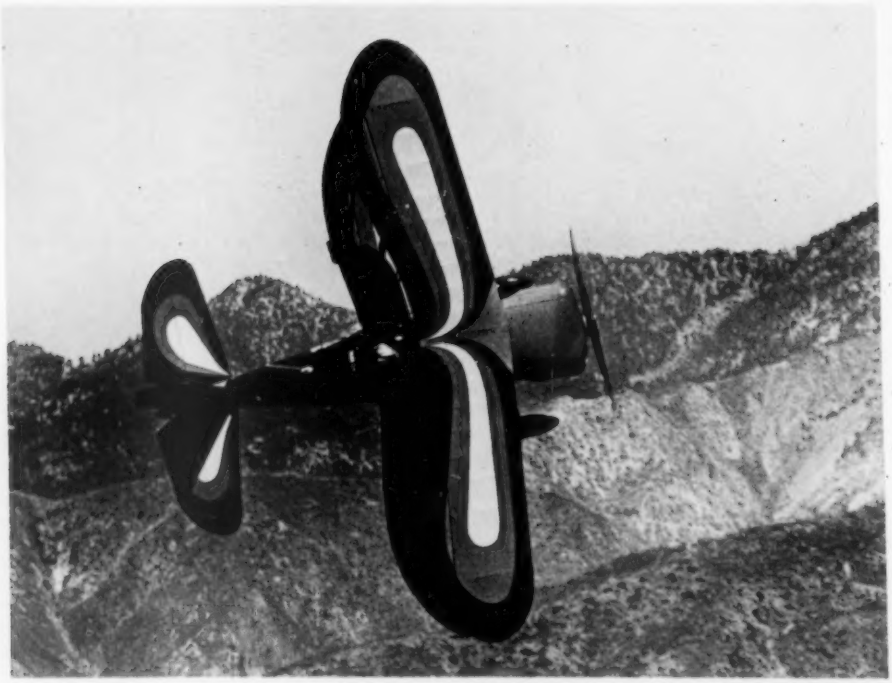
There was no fire, and the subsequent investigation disclosed no evidence of malfunction. It was not determined why the pilot delayed initiating a recovery from the spin. The probable cause ascribed to the accident by the National Transportation Safety Board was simply: "Pilot . . . misjudged altitude."

A look into the accident files of NTSB indicates that those few words apply to the great majority of the accidents identified with aerobatics, or acrobatic flight. The annual number of these accidents is not large —about 35 per year in recent years—and the actual rate (aerobatic accidents per 100,000 hours of usage) is not known, since aerobatic time is not required to be logged. But the fatality rate is clearly the highest on a per accident basis of any type of general aviation flying. Of the 105 accidents classified as "aerobatic" in a NTSB study of the three-year period (1972-74), 74 percent (78 accidents) were fatal, with 107 fatalities.

NTSB investigators acknowledge that many of the crashes occurred following maneuvers which, while technically "aerobatic," in fact would more accurately be defined as "stunting," "skylarking," or "careless and reckless operations," contrary to existing Federal Aviation Regulations. The bulk of the accidents appear to involve absence of good judgment as to what constitutes a safe altitude for aerobatics. In some cases the pilots undertook aerobatic flying after relatively little flying experience, and failed to provide for an adequate safety margin.

A typical case of this kind resulted in a crash at sea off the coast of Melbourne, Fla., in January of 1974. The pilot had less than 100 total hours when he participated in two hours of aerobatic instruction. He then took his aircraft over the sea to practice spins, solo. Soon after his departure a witness observed the aircraft spin into the water. The pilot bailed out and his chute deployed in time, but unfortunately he drowned before a rescue craft could reach him in the heavy sea.

Almost half (42) of the 105 aerobatic accidents occurring in this three year period resulted from stalls or spins from which recovery could not be accomplished within the remaining altitude. In addition, there were 42 accidents where the pilot simply flew the airplane into the ground or water—trees—wires—poles, etc., in the course of, or at the completion of an aerobatic



Some homebuilt airplanes are stressed for aerobatics, some are not. Approved acrobatic maneuvers (if any) for these aircraft are determined at the time of flight-testing for certification. Amateur-built Acroduster is shown being put through paces near Riverside, California.

maneuver.

These figures belie the popular assumption that the chief hazard in aerobatic maneuvers is overstressing the airplane, or incapacitating the pilot. Of the 105 accidents cited, there were ten airframe failures: only three of these occurred to aircraft fully certificated for acrobatics. Five occurred to homebuilt airplanes, and one was in the normal category. (The tenth airplane was uncertificated.) There were also two cases of engine failure, one resulting from fuel exhaustion, and the other from flying inverted in an aircraft not designed for such flying. There was only one case of "blacking out" during a maneuver: in this case both pilot and airplane were subjected to excessive "G" forces and the pilot lost consciousness briefly. During the pull-out, metal was bent on the wings but the pilot recovered in time to land the airplane safely—thanks to the fact that he had begun the maneuver at sufficient altitude to allow for such a condition.

Lack of judgment in executing aerobatics safely does not appear to be a factor of age, experience, or ratings. The age of the 105 pilots who crashed flying aerobatics during this period varies from 20 to 60, with no significant grouping. About one third of these pilots had no more than 600 hours of flying time; another third had over 3,000; the remainder fell somewhere in-between. Sixty-seven of these 105 pilots held a commercial or ATP certificate.

To help reduce the number of accidents by "wildcat aerobats"—those who attempt to fly non-standard maneuvers without the proper training or equipment—and to provide guidelines for pilots who are already into aerobatics or who are thinking of getting involved—the Illinois Division of Aeronautics recently sponsored an Aerobatic Seminar. The meeting was attended by representatives of aerobatic organizations from all over the country, as well as by representatives of aircraft manufacturers, and the Flight Standards Service of FAA. During the two-day seminar, some 200 attendees heard experts define, analyze and comment on all phases of aerobatic flying. Some of the highlights of the agenda included:

Definition of acrobatics/aerobatics.

The term *acrobatic* is used by FAA to define maneuvers involving unusual pitch or bank angles or acceleration. Part 91.71 of the Federal Aviation Regulations describes "acrobatic flight" as an intentional maneuver involving an abrupt change in the aircraft's attitude, an abnormal attitude, or abnormal acceleration, not necessary for normal flight." Part 91.15(c) refers to acrobatic flight as "an intentional maneuver that exceeds (1) a bank of 60° relative to the horizon; or (2) a nose-up or nose-down attitude of 30° relative to the horizon."

Acrobatic is thus a more inclusive term, including not only spins, rolls and loops but also steep turns, chandelles, or lazy eights, for example, whenever these exceed the indicated pitch or bank limits. In this article *acrobatic* will be used to refer to the stress applied to the aircraft, whereas *aerobatics* will refer to the execution of a particular maneuver or figuration. Aerobatics is the word commonly used by pilots.

The maneuvers permitted by FAA for a given airplane depend upon the category of its certificate. A "fully acrobatic" aircraft must be designed to withstand the gravity force of at least six "G"s positive and three "G"s negative. Such aircraft usually have special fuel systems which allow them to be flown inverted, either briefly or indefinitely. Fully acrobatic aircraft are usually without restrictions, except for certain limitations which may be placarded in the aircraft as a result of flight testing.

Aircraft in the "limited acrobatic" or "utility" category are stressed for 4.4 "G"s positive and 1.75 "G"s negative. Most of these aircraft are permitted all types of maneuvers except for sustained inverted flight.

Homebuilt or experimental aircraft which are not designed to a specific standard, are capable of withstanding varying degrees of stress. The limitations of homebuilts with regard to acrobatic flight are determined by the builder, on the basis of theoretical considerations and flight testing.

All other general aviation aircraft are in the "normal" category, which means that they are stressed from 3.17 to 3.8 "G"s positive, and may not be flown in acrobatic flight. The prohibition includes spins.

Pilot Qualification. Although FAA regulates the type of aircraft that may be flown acrobatically, the agency does not require a pilot rating for engaging in acrobatic flight. Pilots are not required to demonstrate the ability to fly acrobatics during flight tests, except that an applicant for the flight instructor rating must demonstrate proficiency in spins and spin recovery. In his address to the Illinois seminar, Bernard Geier, chief of FAA's General Aviation Division, Flight Standards Service, suggested that a program of pilot education might have greater effect in improving safety in aerobatic flying than further regulation or pilot certification at this point. The agency will publish a comprehensive advisory circular on acrobatic flying in the near future, and will provide pilots with other forms of guidance as needed.

As an additional safety measure, and a convenience to pilots, FAA has designated an "Airshow Coordinator" in each of the nine regional jurisdictions in the United States, to assist GADO inspectors as they process waivers for airshows, issue letters of competency (for low-altitude airshow flying) and to help set up areas where low-level aerobatic maneuvers can be practiced.

Aerobatic Training. Virtually all experienced aerobatic pilots agree that *formal* training is the only safe way to get into aerobatic flying, and that selection of the instructor or flight school for this purpose is extremely important. Attempting to learn the technique by simply flying dual with a skilled pilot friend does not result in an absorption of those skills; and teaching one-

self is the least reliable of all learning methods for this type of flying.

Although all certificated flight instructors have some knowledge of aerobatics, there is a great deal of difference between a pilot who participates actively in aerobatic flying and one who is merely proficient enough in spin recovery to maintain his certificate. The several organized clubs for aerobatic pilots, including the International Aerobatic Club, and the Aerobatic Club of America, can provide the names of instructors with outstanding reputations in this field.

Verne Jobst, President of the International Aerobatic Club, and one of the speakers at the Illinois seminar, cautioned pilots new to aerobatics against accepting "quickie" courses at bargain prices. The result of such a course can be a false sense of proficiency, leading to the execution of aerobatics at unsafe altitudes, and possibly failure to recover in time.

Dwain Trenton, representing Great Lakes Aircraft (an aerobatic biplane), advised pilots to stay away from instructors who like to show off at the controls and spend little time discussing maneuvers. A good instructor, in his view, will go over the planned maneuver carefully on the ground, answering all questions patiently before anyone climbs into the airplane. He will explain it once again just before the maneuver is executed, give the student a post-flight critique, and preview the next lesson.

In short, aerobatics should be taught with the same seriousness and attention as any other flying technique, in accordance with the highest standards of flight instruction.

Several instructors participating at the seminar suggested that the best way to get started in aerobatic flying is to take a week or two off from normal work, attend a reputable training school—perhaps out of town—and concentrate fully on learning the techniques. Attempting to "sandwich" brief hours of aerobatic training in between business appointments and family or social commitments does not always result in a thorough absorption of the technique. The more imperfections in a maneuver that stresses the aircraft and pilot, the more additional stress is induced—which can lead to *over*stress, and accidents.

Aerobatic Aircraft. The kinds of aircraft that are designed for aerobatics, or certificated for acrobatic flight, are as different as night and day, with regard to handling characteristics. The pilot who is new to this kind of flying and starts out in a P-51, for example, is probably handicapping himself unduly in terms of difficulty of learning as well as safety.

There are presently five aircraft manufacturers producing certain models of aircraft certificated for aerobatics: Aerotek (Pitts), Beechcraft, Bellanca, Cessna, and Great Lakes. In addition there are a vast number of aircraft no longer in production which are certificated as either fully acrobatic or acrobatic with certain restrictions. This includes many ex-military planes, antiques and classics, homebuilts and other experimental airplanes.

Many older airplanes are prized acrobatic performers, but a prospective buyer should never assume that fact—ask for proof. Some early Piper Cubs, for instance, had no restricted maneuvers, but many similar-appearing later models of Piper were not built for aerobatics.

Beginners are urged to take their training in rental aircraft provided by the instructor, and to build up a familiarity gradually with various kinds of acrobatic aircraft, before acquiring one of their own.

This is especially true for the pilot who has his eye on a particular classic aircraft which may be as unstable and unforgiving and difficult to fly as it is exciting to own. The romantic appeal of historic aviation should not be allowed to jeopardize safety.

Pilots who build their own aircraft should be certain that they have appropriate experience in this type of plane before attempting to fly it—and possibly ruining the beloved project of three year's hard labor—as well as risking injury. The skill and craftsmanship needed to create an airplane is by no means an indication that the builder is capable of flying his own creation. Since the acrobatic maneuvers acceptable for the airplane (if any) must be determined, to the satisfaction of an FAA inspector, at the time of flight testing, the builder should make certain that he has enough experience to rise to the occasion—or he should arrange for a qualified test pilot.

(The second half of this article, scheduled for the July issue, will discuss some of the problems and pitfalls associated with acrobatic airworthiness; special maintenance and inspection considerations for airplanes used in aerobatics; and medical and psychological aspects of aerobatic flying.)

Federal Aviation Regulations that apply to acrobatic flight:

91.71 No person may operate an aircraft in acrobatic flight—
(a) over any congested area of a city, town or settlement;
(b) Over an open air assembly of persons;
(c) Within a control zone or Federal airway;
(d) Below an altitude of 1,500 feet above the surface; or
(e) When flight visibility is less than three miles.

91.15(c) Unless each occupant of the aircraft is wearing an approved parachute, no pilot of a civil aircraft, carrying any person (other than a crewmember) may execute any intentional maneuver that exceeds—
(1) A bank of 60 degrees relative to the horizon; or
(2) A nose-up or nose-down attitude of 30 degrees relative to the horizon.

(NOTE: "Approved parachute" refers to one of an approved type that has been packed by a certificated and appropriately rated parachute rigger within the proper period of time, which varies with type.)

91.9 Careless or reckless operation: No person may operate an aircraft in a careless or reckless manner so as to endanger the life or property of another.

Loss of Gyros

Controlling the aircraft with a partially operating instrument panel

The precision flying that is possible in clouds, without reference to the ground, with the aid of modern gyro-driven instruments—the attitude indicator, the heading indicator, and the turn and slip indicator—is so remarkable that it seems difficult to understand why many fatal accidents involve loss of control in clouds, followed by collision with the ground. In most of these cases, the pilot is properly qualified and instrument-rated: why does he lose control?

One explanation is the willingness of some pilots to undertake a flight, even in instrument weather, despite an apparent malfunction or irregularity in a flight instrument. The heading indicator, for example, may fluctuate abnormally, but the pilot who is pushed by a sense of urgency to get somewhere in the airplane may decide this is no big deal, he has the magnetic compass, and in any case he is going to be flying on the VORs. But if he forgets to check the heading indicator often against the compass, he could easily get off course. If the cause of the heading indicator fluctuation is in the vacuum system, the attitude indicator could also fail, and would the pilot, flying in clouds, recognize the failure in time? And what if he should have a radio failure in flight? Instrument repair is often a vexing problem for pilots who are not based near an appropriately rated FAA-approved repair station, but continuing a flight with a known instrument deficiency is setting the stage for serious trouble.

Another cause of control failure accidents is a tendency to depend too much on a single instrument, such as the attitude indicator, which leads to confusion or even a sense of helplessness if an error develops in that instrument. Such confusion may be prevented if the pilot relates his aircraft attitude to the full panel of appropriate instruments and routinely checks the data from one instrument against another. This will prevent him from developing an overdependency on one instrument, enable him to recognize errors when they occur, and allow him to retain control of the aircraft with backup instruments.

The attitude indicator, for example, is such a convenient means of estimating pitch and bank angle that it is quite easy to fall into the habit of watching it alone—even when the natural horizon is visible. Since this gyro instrument is driven by vacuum pressure in most light general aviation aircraft, any problems in the pressure system would produce an error in the pitch and bank data. Instrument pilots are taught to see the three gyro instruments as a group, to compare the angle of bank shown in the attitude indicator with the rate of turn shown on the turn and slip indicator, and with the change in heading shown on the directional gyro.

Additionally, the data supplied by the gyro instruments should be compared with non-gyro instruments—sometimes called the "performance instruments." The altimeter, for example, is a primary instrument for pitch angle; a nose-high angle on the attitude indicator should be corroborated by a gain in altitude when a normal cruise power setting is retained. The airspeed

indicator is also a pitch angle instrument, showing a gain or loss in airspeed with each change in the nose angle to the horizon. The vertical speed indicator also displays information related to the pitch angle of the aircraft.

If the pilot does not make it a habit to scan all of these instruments, cross checking one with another, and relies only on a symbol displayed against an artificial horizon, he may experience panic when that horizon can not be used, and the natural horizon is obscured by clouds. By the time the pilot (especially if he is flying in clouds for the first time) realizes the instrument is in error, reestablishing straight and level flight may be a difficult problem for him. Applying back pressure on the elevator will not necessarily correct a nose down attitude, if a steep bank has inadvertently developed. Without the attitude indicator, he has no instrument which *directly indicates bank angle*.

A typical cross check would consist of a glance at the attitude indicator and then a glance at a performance instrument; back to the attitude indicator, then a glance at another performance instrument and back to the attitude indicator, etc. During these checks the suction gauge and ammeter should be checked to ensure early detection of a malfunctioning power source. A loss of suction on aircraft with vacuum driven gyros would require immediate transfer to the partial panel technique of instrument flying.

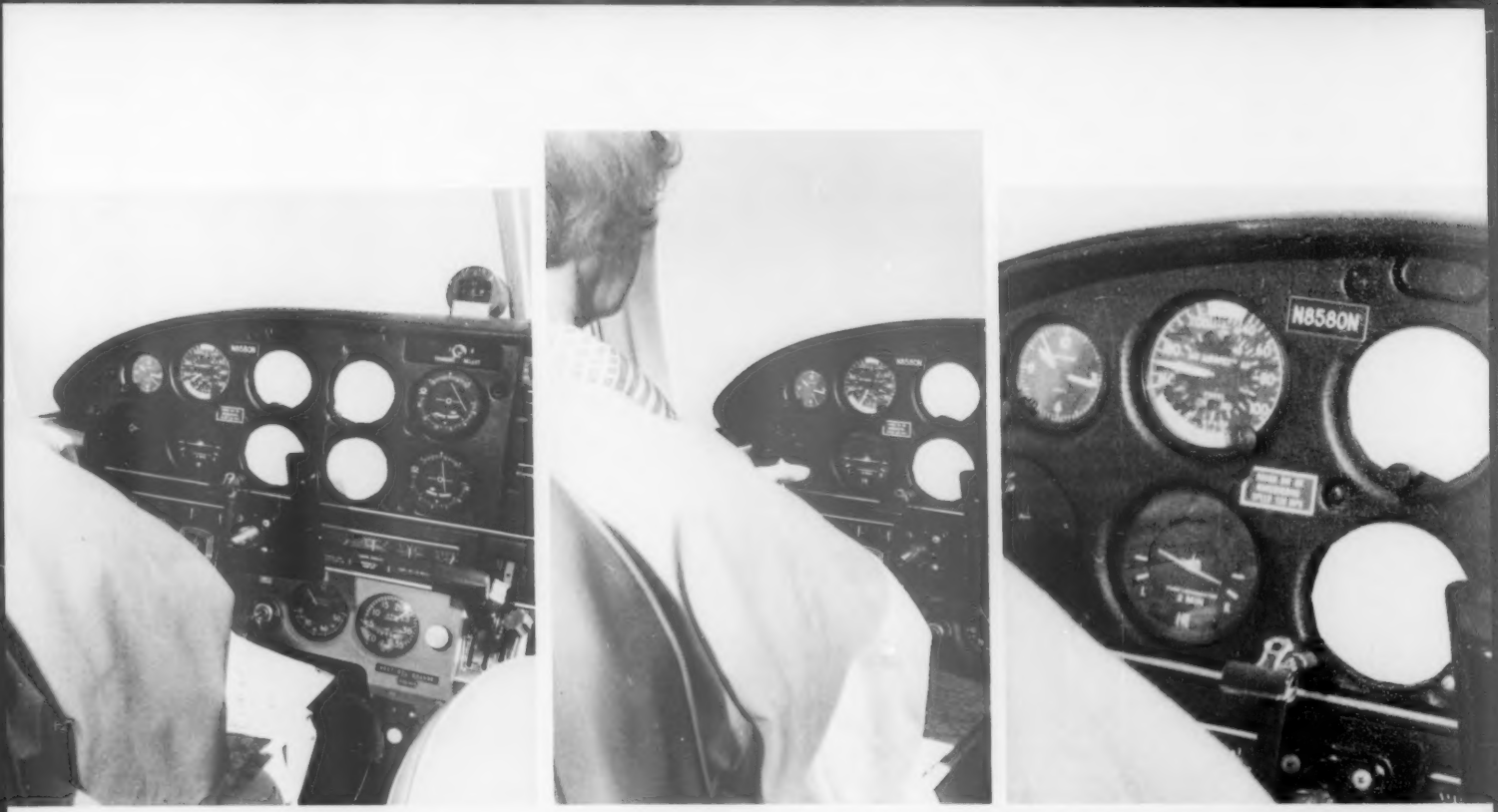
In most light general aviation aircraft the turn and slip indicator is the only one of the three gyro driven flight instruments that is electrically driven, so that in the event of vacuum pressure problems it is the only one the pilot can rely on. (In older aircraft, *all* gyro instruments may operate on vacuum pressure.)

The terms "turn and slip," or "needle and ball" are accurate descriptions of this instrument, which is sometimes also referred to as "turn and bank." The angle of bank, if any, may *not* be read out from the instrument face, but only inferred. The displacement of the needle from either side of center indicates the *rate of turn*—not the angle of bank. If rudder and aileron controls are not coordinated, it is possible for the wing to be banked steeply with little or no turning of the airplane—so that the needle would remain centered. However, the position of the ball will tell the pilot if he is in a slip, and which wing is down. If a pilot in the clouds is unaware of the bank angle and pulls back on the wheel to reduce airspeed or gain altitude, he could easily bring about a stall and/or a spin.

In the absence of a properly functioning attitude indicator, pitch control is established from the altimeter, airspeed indicator and vertical speed indicator. The altimeter should be read in connection with the airspeed indicator. It is possible, for example, for the altimeter to hold steady while the aircraft is approaching a stall condition—in consequence of an unintentional bank in clouds.

In the absence of a reliable directional gyro, control of the aircraft around the yaw axis is retained by means of the magnetic compass and the needle and ball. In turbulence the needle will fluctuate considerably, often to either side of center, but the pilot can determine whether his aircraft is actually turning by noticing any preponderance of deflection to one side. The magnetic compass, of course, will not give an accurate heading indication unless the aircraft is flying straight and level and steady. It helps to remember that in turns the magnetic compass lags behind the aircraft when it is turning away from north, and leads the aircraft when it is turning away from south. In either case the lag continues until a heading of east or west is passed.

Another factor known to play a large role in bringing about accidents involving instrument failure is inadequate preflight in-



Partial panel practice. *Left*—normal flight. Airspeed (a normal 133 knots) indicates no up or down pitch while turn indicator (wings level, ball centered) shows no turn. *Center*—wings are level, but airspeed is down to 120 knots, indicating a straight ahead climb. Lowering the nose will get the airplane back to level cruise. *Right*—airspeed is going up, and turn indicator says "tilt", warning of a diving spiral.

spection. Every preflight check, VFR or IFR, should include specific procedures for determining the condition of the flight instruments.

BEFORE START UP:

• **Physical condition.** Check instruments for broken or loose knobs, worn markings, weak mounting, appropriate power-off indications of instrument pointers and warning flags.
• **Caging, fluid.** Check heading and attitude indicators to make certain they are uncaged (if they are a cageable type; some are not). Check turn and slip indicator and magnetic compass for fluid level (should be full).
• **Electrical gyros.** Switch on and listen for any unusual or irregular noise.

AFTER STARTING ENGINE:

• **Warming up.** Check instruments for erratic displays, excessive warm up time, and proper operation of warning flags, indicating lights and test circuits.
• **Pressure.** Check for appropriate suction or vacuum pressure (Note: excessive pressure is just as serious an indication of trouble as insufficient pressure).
• **Heading indicator.** Allow five minutes after starting engine for the gyro rotor of the vacuum-operated heading indicator to attain normal operating speed. Cage the gyro and uncage it, simultaneously pulling out and turning the knob. (If the card continues to turn, the gyro is not operating properly.) Before taxiing or while taxiing straight ahead, set the heading indicator to correspond with the magnetic compass. Before takeoff recheck the heading indicator. If your magnetic compass and deviation card are accurate, the heading indicator should show the known taxiway or runway direction when the aircraft is aligned with it (within 5°).
• **Attitude indicator.** Allow five minutes to attain normal rotor speed, after starting engine. If the horizon bar erects and remains at the correct position for the attitude of the aircraft, it is operating normally. It is also normal for the bar to vibrate briefly after reaching the correct position. If the horizon bar alters position during straight taxiing, or tips in excess of 5° during taxi turns, the instrument may be unreliable.

The miniature aircraft symbol should be positioned as appropriate for the given aircraft while on the ground. For some tricycle-gear aircraft, setting the symbol in a slightly nose-low attitude on the ground will give a level flight attitude in the air at normal cruising speed. (A mild precession from horizontal may be expected during sharp taxi turns.)

• **Turn and slip indicator.** Check for positive return of the needle to center position by depressing one side of the shock-mounted panel and releasing. Deflections and return can also be noted during taxi turns. Also, the ball should move freely in its tube and no bubbles should appear in the fluid.
• **Electric gyros.** Allow three minutes for the electric gyro to attain operating speed. If you have an electric slaved gyro compass, it should be compared with the magnetic compass, and also against known headings on the ground.
• **In flight.** In addition to cross-checking the attitude instruments against the performance instruments, observe the suction gauge to make certain vacuum pressure is within acceptable limits. The major cause of malfunction in air-driven gyro instruments is contamination from impurities in the cabin air, especially moisture and dirt, and including tars from tobacco smoke. Since contamination will settle on the tiny rotor bearings, the resulting friction may reduce rotor speeds and even lead to bearing failure.

Keeping the cabin free of dirt, dust and smoke is one way of prolonging the life of your vacuum-driven instruments. Air filters for the gyros are generally available, and if your aircraft vacuum system has none you might consider getting one installed in an accessible location where it can be removed easily for checking or replacement. Some mechanics maintain they can guess fairly accurately the number of cigarettes smoked in an aircraft between filter changes by the amount of tar present.

Maybe the aircraft is trying to tell us something.

(*Note: the first half of this article, "Spinning Wheels," in the May issue discussed the design characteristics of gyro instruments.*)

How to protect yourself in the water until help arrives

Survival at sea, involving hours or even days of bobbing about in a vast ocean following an emergency landing on salt water, is a problem that most general aviation airmen will never have to face, fortunately. When a small land plane does go down on water it is seldom far out to sea, and usually a radio call brings a Coast Guard helicopter to the scene within a few minutes. All the occupants of the downed plane have to do is keep afloat long enough for the rescue to be effected. At this time of year exposure to the elements for a brief period of time does not normally constitute a threat to life, except for one particular aspect of these maritime elements: the shark.

This celebrated villain of the deep with the large teeth has had so much heavily dramatized publicity in recent years that it is difficult to be objective about the actual danger it presents to the airman who might have to abandon his aircraft at sea. However, there are an estimated 100 shark attacks on human beings every year (world-wide), and about one half of these are fatal. At the present time, the great majority of attacks occur to persons bathing in the sea, or to shipwrecked survivors. But the wartime annals of the military services contain many grisly accounts of shark attacks on airmen downed at sea, and there is the further consideration that when shark attacks are successful no evidence is left to explain the fate of persons who simply disappeared in the water.

Consequently, civilian airmen who venture out over the sea should be aware of this potential danger, and be equipped to deal with it. Beginning in World War II a great deal of study has been given to shark behavior toward human beings, and methods of protection against shark attacks. Sharks are said to have small brains, but they are endowed with numerous ingenious devices that make them the number one predatory creature of the sea.

Many sharks not only have excellent hearing, but also externally located sensors which enable them to pick up vibrations or changes of pressure in the water at great distances, so that the impact of an aircraft crash at sea is likely to attract hungry sharks cruising within a radius of several miles. Their sense of smell also is keen, and is used to bring the sharks to within striking range of their prey. And finally, contrary to some popular mythology, sharks have a good sense of vision, and rely on it when closing in.

Marine biologists have catalogued over 250 different species of sharks, of which only about half a dozen species are considered dangerous to man (whale shark, gray nurse, tiger shark, bull shark, hammerhead and white tip). They range in size up to nearly 30 feet in length and several tons in

Radioed "ditching" message brings quick response from Coast Guard rescue helicopter, which is shown lowering sling to life-jacketed survivors.

Life raft simplifies rescue at sea while protecting survivors from marauding shark or barracuda.

weight. Distinctive features are the "chinless jaw," the array of gill slits at the side of the head, and the large tail.

Despite the more than 30 years of fairly intensive study of shark habits since World War II, no one is in a position to predict what any given shark will do in any given circumstances. Jean-Jacques Cousteau, the foremost living marine biologist, says simply that the more we learn about sharks, the less we know.

For example, it is a statistical fact that most shark attacks occur in water above 70° Fahrenheit. But it is also a fact that most recreational swimming is done in water above that temperature, so that shark appetite cannot be related to water temperature on this evidence. It is also a fact that ten times as many males have been attacked by sharks as females, but this could as well be due to the more adventuresome behavior of males in the water, rather

than to a sexist prejudice on the part of sharks, or to an adverse reaction to feminine hormones, as some observors have suggested.

The one fact that is of significance to airmen is the clear indication that an accident survivor at sea has a much better chance of being rescued alive and intact if he is in a life raft, than if he is actually in the water. Experimentally it has been shown that sharks are attracted to low-frequency, pulsed sounds in the water, particularly if the pulsation is irregular, such as the sounds made by distressed fish —or persons—struggling or thrashing about in the water. Hence, attempts to swim to shore, even with the aid of an inflated livevest, could draw the attention of sharks, many of which are not at all averse to foraging in shallow waters.

The possibility that sharks might also be attracted to the rotor noise of helicopters was investigated by the Office of Naval Research in 1976, out of concern that this might be a hazard to rescue operations conducted with helicopters. Thus far no conclusive evidence has been published.

The shark's keen sense of smell poses a greater danger to crash survivors who are actually immersed in the water. The notion that sharks are attracted to blood—even faint traces of it—is no myth. Sea laboratory experiments have shown that sharks can be attracted to certain organic chemicals found in living matter—amines, for example—in extremely low concentration in the water, literally in parts per billion. Navy and Air Force survival manuals caution airmen against removing clothing in a ditching at sea, in part because of the danger of "contaminating" the water with human scent.

Sharks are also sensitive to extremely weak electric fields in the sea, the type of field generated by living organisms.

At an earlier date sharks were popularly believed to be color blind, but more recent research indicates that the most dangerous sharks can see colors well, though which colors is not known. Brightly colored survival gear (designed to facilitate rescue efforts) if visible below the surface of the sea, might assist sharks in finding their victims. This is another reason why lifevests are not as satisfactory as life rafts for survival at sea.

There is no documentary evidence of sharks successfully attacking persons by damaging or sinking a raft. (Rafts *have* been swamped or overturned, with serious or fatal results when sharks were in the vicinity). The modern practice of using a dark or black painted underside of the raft and a brightly colored upper surface appears to mimimize visual attraction from unwanted visitors below and maximize visibility for airborne spotters.

Part of the research conducted since World War II has involved the testing of a wide variety of passive shark repellents, including not only chemicals but also electric repellers, lights, sounds, and a bubble curtain to protect swimming areas. Also studied were active devices such as the "bang stick" or "power head" (employing an explosive), and the CO_2 dart gun. At first it was believed that these active devices were the best bet for survival, but it was soon realized that weapons which are lethal to sharks could also be dangerous to the persons using them, unless handled with great skill, and after much practice. Also, injuring or agitating a shark can increase the intensity of its attack.

Consequently the Navy developed a passive chemical repellent or "shark chaser," which was used by the Air Force as well as the Navy and also made available commercially. Scientists had observed that living sharks appeared to avoid the vicinity of a dead shark, and they determined that

"Shark screen", which holds survivor upright in waterproof plastic bag, folds to pocket size and has flotation rings inflated by mouth.

the most odorously prominent of its decomposition products was a form of acetate. The shark chaser eventually consisted of a combination of copper acetate and a black dye, nigrosine, bound together in a wax bar or cake that is water soluble. The dye was intended to make it more difficult for the shark to find his victim, in the event he was not put off by the chemical scent.

After nearly 30 years of providing shark chasers, the Navy has recently concluded that there is no reliable evidence it serves any purpose other than possibly bolstering morale. This view is supported by marine biologists such as Cousteau, who has shown convincing underwater films of sharks, when hungry, zeroing in on bait regardless of copius amounts of dye and acetate in the water.

Here again, the unpredictable nature of sharks is a disturbing factor. In shark pens, the nigrosine dye has been found to be effective as both a feeding inhibitor and a repellent—*some* of the time, and for *some species only*. Whitetip sharks, for example, cruised serenely through the stained water even when no food was present. A grey reef shark was seen swimming off with a cake of dye in its mouth—as well as the bait the dye was intended to protect. In the open sea of the Pacific an actively feeding shark gulped down an open packet of shark chaser, but spat it out again.

Furthermore, there are some conditions in which the shark chaser actually attracts sharks, at least initially. In open sea on surface waters, a dense, coherent cloud of dye that has not yet begun to diffuse sometimes attracts large predatory fish like sharks. In fact, sharks are likely to investigate any interesting object on the surface.

The only effective alternate to a liferaft which has undergone successful experimentation is the "shark screen," a waterproof bag made of thin, strong, but light synthetic material that can be folded into a small package and carried in a lifevest. The bag has three inflatable collars which can be orally inflated by the survivor. He then fills the bag partially with water and climbs into it. The submerged portion of the bag is painted black and completely conceals the occupant from any sea attackers. Body effusions (sweat, blood, etc.) are contained within the bag and so provide no attractive scent for interested sharks. The upper color is brightly painted to aid rescue spotting.

Some problems with the bag, or screen, remain, including the ability of an injured person to rig it and climb into it. The bag cannot be steered or propelled like a raft, and it does not afford the occupant any protection from the effects of the sun or the sea water. But it is an extremely handy device, small enough to be put into a jacket pocket, and for conditions at sea when rescue can be expected within a few days or hours it should serve far better than a life jacket alone as protection from sharks.

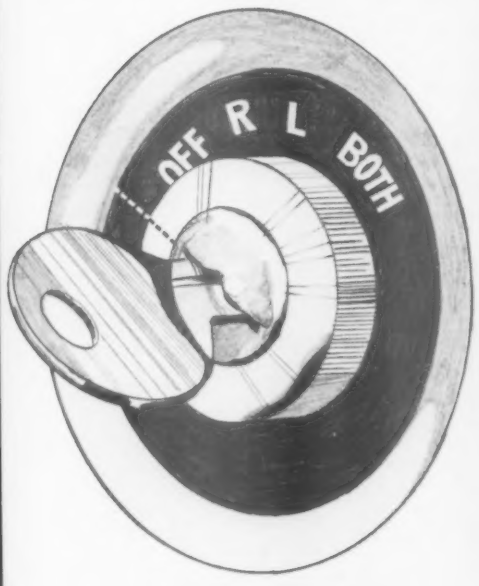
Survival at sea is an important consideration for airmen, even though they seldom venture far from land, and no shark attacks have been reported in the areas they visit—*yet*. Sharks have an uncanny way of upsetting the law of probability. A New York banker, Herman Oelrichs, once offered a $500 reward for any authenticated report of a shark attack on a human being along the north Atlantic coast. For 30 years, until his death in 1916, the reward went unclaimed. A few weeks later there were five separate shark attacks off the coast of New Jersey, with four fatalities.

The liferaft you buy or rent may take up more space in your cabin than you would like to yield, and the chances are you will never use it, but. . . .

Who wants to take chances with a shark?

(NOTE: portions of the material presented here were taken from articles in ***Naval Aviation News,*** *written by Bernard J. Zahuranec; from* ***Airmen Against the Sea,*** *published by the Arctic, Desert, Tropic Information Center, USAF; and from publications by Mote Marine Laboratory, Sarasota, Fla.)*

SWITCH



OFF?

How you can make sure the prop is not hot

An Airworthiness Directive, 76-07-12, calling for a mandatory check and repair (where necessary) of certain models of ignition switches was issued by FAA's Eastern Region in July of 1976, after it was determined that a potentially hazardous condition existed, with respect to the grounding mechanism. The problem, when it exists, is one of wear, which could allow the switch to slip past the "off" setting to a point where the system is no longer grounded.

FAA has since concluded that the safety of virtually all single-engine, piston-driven aircraft operations would be enhanced if pilots made it a habit to check periodically for wear defects in their ignition switch, in the following manner:

1. Prior to flying the airplane, follow regular ground run-up procedures, allow the engine to reach operating temperatures and perform a normal magneto check.
2. With the engine at *normal idle*, rotate the ignition switch key or lever to, and through, the "OFF" position to the extreme limit of its travel, and hold momentarily. *The engine should stop firing.*
3. Release the switch. It should spring back directly to the "OFF" position, and the engine should not run.

If the response to either of these actions (2 and 3) is not as indicated, the switch is faulty and should be examined by your mechanic. The malfunction should be reported to your local FAA district office. Failure of the switch could lead to "hot prop" accidents when the aircraft is moved or handled on the ground (see "Magneto Magic" in the April issue for a detailed explanation of this hazard).

Relatively few problems have occurred with ignition switches, but the possibility always exists that simple mechanical wear, after years of dependable use, can lead to imperfect performance. Since the engine is normally shut down at the end of a flight by use of the mixture control, and the ignition switch is not moved to the "OFF" position until after the propeller has stopped, defects in the switching mechanism would not become apparent to the pilot in normal conditions. If undetected defects did exist, they would not only be a hazard to persons on the ground, but they could also lead to loss of an engine and other serious consequences in flight—if, for example, the engine experienced severe vibrations and had to be shut down immediately.

If the switch tests normal, occasional rechecking by the pilot or operator should be adequate. However, many experienced pilots make an ignition switch check part of the daily preflight procedures, on the grounds that what you don't know about your airplane *could* hurt you.

The Most Famous Flyer of All

Day of the Lone Eagle

The date is May 20, 1927, and the aircraft revving up at the threshold of Roosevelt Field on Long Island, N.Y., looks like a designer's colossal bungle. It is a big, radial-engined monoplane with an enclosed cabin that is almost completely occupied by fuel tanks, with the pilot jammed behind it . . . and the wing over his head . . . no forward visibility at all. But that is what the pilot, known as "Slim," had asked for.

"You don't need forward visibility when you're flying over an ocean," he told the designer. "If we can pick up a little more airspeed, a little more range, by streamlining the pilot in, I want it."

What he wanted more than anything else was to succeed, to be right, to be the first to fly across the ocean; and to accomplish this feat—which had cost the lives of half a dozen pilots in the past several months alone—he was willing to gamble everything on his own judgment. He alone had chosen the aircraft builder and directed the design; he had lived in the shop for the frenzied two months of construction, had test flown the airplane, planned the routes, calculated every last detail—he even filtered the fuel and screened the engine oil himself. In ten years of flying he had gambled with his life many times, but always he knew how to keep the odds in his favor—which is why they also called him "Lucky." His flying record as daredevil barnstormer, crack Army pilot and pioneer airmail flyer had earned him the confidence of his financial bankers in St. Louis, who wrote out a $15,000 check to his name and said, "Get an airplane and fly to Paris."

The opportunity of a lifetime, perhaps of a century, for a 25-year old gangling youth who had spent most of his life in transit, who had scarcely completed a whole year in any one school, who had learned to live out of a duffle bag strapped on a motorcycle thrown in the back seat of an airplane. Now, for the first time in his life he knew where he was going.

To Paris.

Early in his preparations he determined that he must weigh the odds either in favor of succeeding, or of surviving. He was sure of the plane, the engine, and his own skill; he could not be sure of the weather. But if he had enough fuel he could fly around or above the storms, he could get lost and wander all over the coast of Europe; but it was too big a target to miss—and if he had enough fuel he could get to Paris.

To consider *surviving*, in the event of a mechanical failure, he would have to think about a parachute, radios, a blanket, a tarpaulin, etc. It all added up to extra weight—and less fuel; he would go without them. Equipment was pared to the bone; even fuel gauges were dispensed with, for the few ounces of weight involved ". . . they aren't accurate, and I have my watch." He did buy a ten dollar liferaft, but left the oars behind.

In the end his "Spirit of St. Louis" was little more than a flying fuel tank; 450 gallons—or 2,750 lbs. crammed into a plane that empty weighed only 2,150 lbs. The unpaved runway was soggy from the all-night rain, and there were wires and trees at the far end. Some 3,600 miles beyond lay Paris.

He had never even taxied the aircraft with this much weight, but the sun was burning off the fog, and every minute he delayed would cost him daylight on the flight. The apparent break in the bad weather over the north Atlantic had not been reported to him until the evening before, and the night had been so filled with final preparations that he had not even had time to close his eyes—and they would have to remain open and alert for at least another day and a half. He had not really rested well during the entire three months of feverish construction, testing and planning, knowing that other, larger aircraft with more experienced crews were being readied to accomplish this historic first flight. It was not the honor or the prize money ($25,000) that beckoned him; it was the chance to do

something really big for the first time—on his own. He said that he preferred the extra fuel to having a navigator with him, but it is also likely that he really wanted to go it alone. The airplane was companion enough; it alone carried all his hopes, knew his secret dreams and inner doubts; when he wrote about his flight later he called his book, "We."

Once he heard the engine singing sweetly his weariness and misgivings disappeared. He was ready. He signaled for the chocks to be pulled. Starting down the mile-long runway, the aircraft felt more like an overloaded truck than a flying machine, and the engine sounded weak and frustrated. *Would it overheat before they got off the ground? What kind of blaze would 460 gallons of aviation fuel make?* One thousand feet went by, then two, and three—and finally a bump as the wheels started to leave the ground. The small crowd on the field let out a cheer as "Lucky's" plane passed over the wires with 20 feet to spare, banked gently around a clump of trees and headed out over Long Island Sound.

The daylight leg along the New England coast and up to Newfoundland, flown for the most part at a low altitude, just over the water, offered no real problems except for intermittent clouds. But as the silver plane passed over Newfoundland and headed toward Ireland, 2,000 miles away, the sun went down and a heavy fog obscured the sea, which was dotted with sizable icebergs. He tried to fly above the weather, but even at 10,000 feet he was below the cloud tops and picked up icing. Patiently he worked his way around the clouds, confident in his fuel reserve. For hours he flew through heavy fog which, in the early dawn began to break up into patches and assumed mirage-like forms of trees and landscape, so that he half-expected to collide with a solid object any moment.

Then the fog cleared and he was able once again to drop down low over the sea. A fishing boat appeared, with an incredulous face in the porthole as the pilot shouted, "Which way's Ireland?"

The Irish coast appeared, directly on course. Two hours later he sighted England, then flew over the Channel and the city of Cherbourg. As he approached Paris he began to feel an odd sense of regret that the flight was nearly over, the long struggle at an end.

Perhaps he sensed that once his wheels touched down he would never again be the same private person, free to go his own way, like an eagle, but would belong to the multitude on the ground that even now was beginning to chant his name as his plane passed over Le Bourget Field. He considered briefly going on to Rome—wouldn't that shake them up?—but dismissed the temptation, landed at Le Bourget and surrendered himself to a hero's welcome.

Vive Lindbergh!

BRIEFS

AVOID THE FIRE LINE. Forest fire fighters advise that general aviation pilots can be of help in fire suppression efforts only by staying far, far away from the scene. Helicopters and airplanes play a large part in present-day methods of fighting forest fires, but are greatly hindered in their efforts when transient aircraft carrying sightseers and the news media fly in and around the fire area. Such operations not only disrupt delivery of firefighting personnel and supplies, they also pose a severe hazard to the safety of all concerned. IMPORTANT NOTE: FAR 91.91, which provides for temporary flight restrictions over incidents or events that might attract crowds of sightseers, does cover occurrences such as forest fires. If a NOTAM to this effect is issued, authorization to fly in the area must be obtained from the FAA Air Traffic facility named in the NOTAM.

CLEAR FOR TAKEOFF? Some pilots who take great pains to plan carefully for the en route and landing phases of their flight make almost no preparation regarding takeoff. As a result, according to a National Transportation Safety Board report, in a five-year period (1970-74) about one out of every five accidents occurred on takeoff, and 16 percent of the fatalities and serious injuries resulted from takeoff accidents. Factors in the departure accidents included such things as weight and balance; ice and frost; density altitude; winds; runway conditions; cold weather. A complete discussion of the subject is found in a new FAA Advisory Circular, "Role of Preflight Preparation", AC 61-84, available free from DOT/FAA Distribution Unit, TAD 443.1, Washington, D.C. 20590.

RADOME REPAIR. The radome, the cover that protects an airborne radar antenna, is scientifically designed to serve that purpose. It is important that the radome be inspected regularly and repairs made promptly; even a pinhole can allow moisture to enter the radar compartment and damage the equipment. In addition to holes, radomes are subject to dents and scratches caused by impact with stones or birds or improper ground handling. Deformation can degrade the passage of electrical signals. When repairs are made, they must be done precisely. Guidelines on such repairs are contained in a new free FAA advisory circular, "Maintenance of Weather Radar Radomes" (AC 43-14).

TOO MANY RADIOS SPOIL THE NAVIGATION. Pocket-sized portable radios that receive aircraft navigation and communication frequencies are handy to have and fun to listen to—but never on board an aircraft. So warns FAA in a new Advisory Circular, reminding pilots that the operation of these radios in the air could interfere with the airborne navigation system. Furthermore, the FARs require that aircraft operators not allow electronic devices (except specified exceptions such as hearing aids, pacemakers, etc.) on any IFR flight or commercial or air carrier aircraft. AC 91-47, "Use of Portable Electronic Devices—Radio Receivers" is free from FAA/DOT Distribution Unit, TAD 443.1, Washington, D.C. 20590.

CLASSY CHASSIS. The nation's oldest commercial airliner, a Western Airlines Douglas M-2, arrived in the Washington, D.C. area after a flight from Los Angeles. The 1926 open-cockpit, red-and-silver fabric biplane, which is to go on display in the National Air and Space Museum, is the last of the original mail planes still flying. The craft, which originally carried mail, express and two passengers in the front compartment, has a World War I 12-cylinder water-cooled 440 hp Liberty engine. After throwing a rod en route, the pilot landed at Amarillo and borrowed another Liberty engine from a Santa Fe museum.

1976 Award Winners Named

The 1976 recipients of the Flight Instructor of the Year and the General Aviation Mechanic Safety Awards have been chosen. The two men will receive their awards on June 28 at a ceremony in Washington, D.C.

Top flight instructor, is E. Allen Englehardt of Lake Bluff, Ill. who is being honored for his thorough and inspiring methods of teaching and for his success in promoting aviation safety.

An independent instructor, Englehardt became concerned last year over possible confusion among some pilots as to the correct understanding of a recently amended regulation covering "unpublished routes" and the use of radar in instrument approach procedures (FAR 91.116f). In his capacity as a volunteer accident prevention counselor, he printed a helpful discussion of this rule and distributed it at his own expense to all instructor pilots in his area.

Englehardt, 30, is also a pilot for United Airlines, and has an A & P mechanic rating in addition to his pilot and instructor certificates. He has been flying for ten years.

Mechanic Award will go to Richard C. Wartinger of Dayton, Ohio who developed a forced-air cooling system and an improved testing procedure for Nicad batteries. Wartinger was chosen from among nine regional winners:

Leonard E. Colp	Washington, D. C.
Robert Lynn Armour	Memphis, Tenn.
Bernard Rios De La Torre	Tempe, Ariz.
Gilbert Aragon	Sante Fe, New Mex.
Edson F. White	Holyoke, Mass.
Arnold H. Fuller	Ogallala, Neb.
George A. Ward,	Friday Harbor, Wash.
Johann Eriendsson	Barrow, Alaska

Special Procedures for Oshkosh

In anticipation of heavy traffic in the Oshkosh, Wis. area during the Experimental Aircraft Association (EAA) Fly-In, July 30-August 6, FAA has established special air traffic procedures for Wittman Airport during this period. Two separate traffic patterns will be used, with itinerant aircraft using Runway 9/27 and experimental and vintage aircraft using Runway 18/36. Runways 4/22 and 13/31 will be closed from five days before the Fly-In to five days after. Traffic pattern altitude is 600 feet above the ground or 1400 feet MSL.

Pilots will, for the most part, receive instructions by monitoring the radio and following directions from flagmen on the ground.

VFR Arrival Procedures: Inbound pilots should monitor ATIS on 125.8 when at least 30 miles out, listening particularly to see if the "Omro Special Arrival Procedure" is in use. The Omro Procedure calls for all inbound VFR aircraft to fly first over the town of Omro (eight miles west of Wittman Airport) before proceeding to the airport. Pilots should maintain a close watch for other traffic at all times within 75 miles of Oshkosh.

When "Omrd" is in use call the "Omro Controller" at Oshkosh Tower on 120.7 when ten miles from the town of Omro. Depending on traffic you will either be asked to hold at Omro or proceed to the airport from Omro. In the latter case you should fly east along the south side of Highway 21 to the intersection of Highway 41, which is a four-lane north-south expressway, then turn right and fly south along the expressway to the blue water tower which is one mile northwest of Wittman Field. *When instructed* switch to the regular Oshkosh Tower frequency, 118.5.

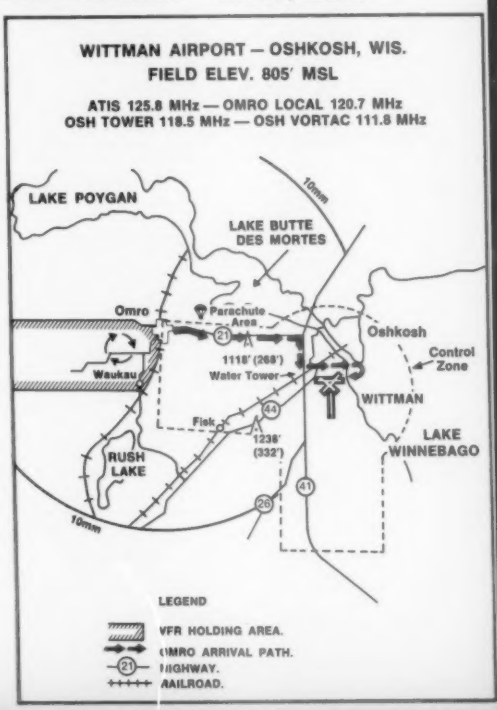
At the water tower, enter the appropriate traffic pattern as follows: For Runway 9 (left traffic) enter directly onto a left base leg from over the water tower. For Runway 27 (right traffic) turn left at the water tower, which will put you on a right downwind leg for Runway 27. Landing pilots should be alert for possible waveoff, either by radio or from controllers on the ground near the approach end of the runway.

After landing pilots should turn off on the grass as soon as possible following directions from flagmen. *NOTE: Please check ELT before shut-down.*

Non-radio traffic may operate in the Oshkosh area only if a waiver has been obtained in advance from Oshkosh Tower.

VFR flight plans should be closed by arriving pilots, just before or after landing, with Oshkosh Radio (transmit 122.1 and listen 111.8).

Pilots planning to fly to Oshkosh IFR should check AIM Part 3A or with FSS for details, since special IFR procedures are used by Chicago Center during this period.



• Monday or Tuesday?

In reference to your article on Chuck Yeager and the X-1 (February 1977 issue), if General Yeager broke the sound barrier on October 14, 1947 it was Tuesday, not Monday, as printed in your article.

Claude B. Masters
Pooler, Ga.

• The REAL Chuck Yeager

I enjoyed the article in the February "News" but wonder why you used a picture of Chalmers S. Goodlin (Slick) with it. Slick was the Bell Civilian test pilot for phase I on the XS-1. He made 20 powered flights and took the aircraft to 40,000 feet and .8 Mach, before the Air Force took over the project for Phase II—.8 to 1.1 Mach.

Chuck Yeager
Cedar Ridge, Calif.

Our apologies—we were supplied a misidentified photograph. See above for the REAL Chuck Yeager.

• Appliance Records

In your recent article on "Service Logs" you appear to minimize the importance of keeping required records on aircraft appliances. We have new regulations requiring inspections and ADs to be performed on appliances. In addition the FARs describe major repairs and alterations to appliances. Therefore, appliance record-keeping should have a related importance with airframe, engine and propellers.

Keith R. Thompson
Van Nuys, Cal.

Quite so. Appliance record-keeping was mentioned at several points in the article, although perhaps not emphatically enough.

• Contacts for Pilots

Your January issue reports that FAA now allows pilots to use contact lenses instead of glasses, without a waiver. I think FAA should reconsider this rule. If a pilot should get something under a lens—and I've seen this happen countless times—while he is in the air, I can foresee many problems. Removal takes two hands: who flies the plane? The head must be bent for removal; this could induce vertigo. With one lens out, depth perception is impaired. Finally, there is no guarantee the lens will be reinserted properly on the first try!

Charles A. Keller
Marblehead, Mass.

FAA has no evidence that the use of contact lenses, as permitted, compromises aviation safety, and we know of no accidents or incidents where their use was a factor. Although it is painful to get something under a lens, the chance of this happening during normal flight is remote. If it should occur, most users would be able to quickly and easily remove the lens. In normal, stabilized flight the head movements required for removal should not induce vertigo. Also, loss of depth perception with one lens removed should not present a significant problem.

FAA is interested in hearing from airmen with regard to any problems known to arise in connection with this rule change.

• Flying With Dry Ice

Your magazine is proving very helpful to this new pilot. I have a question which may be of interest to other pilots:

I have a friend who flies to Canada each year to fish. He freezes the fish and then packs them in dry ice to fly them back with him. I contend that the carbon dioxide gas released from the dry ice is a hazard to him while flying in the small enclosed space of the cockpit. He says it is not, inasmuch as sufficient fresh air is always entering the cabin and expelling the carbon dioxide.

This summer I plan to go fishing in Canada and wonder about bringing back fish packed with dry ice. I would not want to subject myself or passengers to any hazard.

Lester H. Christiansen
Lincoln, Nebraska

Solidified carbon dioxide (dry ice) is a "regulated material" under the "Hazardous Materials Rules". To carry it on board an aircraft you would need to meet the requirements of those rules regarding quantity carried; location in the aircraft; packaging, etc. Because those requirements would vary depending on factors like whether you will be in a private aircraft or a charter, or whether your airplane has a separate luggage compartment, we suggest you consult with the "Hazardous Materials Specialist" at your FAA District Office (FSDO or GADO). He can advise general aviation pilots on what they can or cannot carry in their airplanes, and any restrictions or cautions that might be involved.

• "I've Got It!"

I haven't got it—yet. I may be missing something but was a bit confused in reading your article "Respecting Military Airspace" (March 77). My problem stems from trying to figure out how an airplane, reported to be flying at 600 feet altitude, could be put into a dive by an instructor who shouted "I've got it!" and then "leveled off at 800 feet". Please tell me if "I've got it" wrong?

G. J. Baron
Laurelton, N.Y.

It makes better sense if the line that was dropped in production is re-instated. The sentence should have read "Unhurt but shaken the instructor climbed to pattern altitude, leveled at 800 feet and turned downwind." Thank you for calling attention to the error.

FAA GENERAL AVIATION NEWS welcomes comments from our readers. No anonymous letters will be used, but names will be withheld on request. Address: FAA GENERAL AVIATION NEWS, AFS-807, Washington, D.C. 20591.

• High-time Pilot Problems

I enjoy each issue of the *FAA General Aviation News*, especially the accident reports you publish. These reports always make for good reading and point out valuable information, but they are invariably on low-time pilots. It would be most interesting to me if you would also have articles on crashes (with cause and circumstance) of a commercial and/or scheduled airline crash. High-time, experienced pilots do occasionally crash, usually for a very interesting reason with a lesson to be learned.

Bruton T. Dawkins
Pineville, La.

An interesting idea. We are researching statistics on the subject with an eye toward publishing an appropriate article soon. Meantime, for an account of one high-time pilot accident, see "The Impossible Climb" in the February 1976 issue.

• Radar Myth-Conceptions

Congratulations to you and Charles Douglas for another outstanding article, "Radar Myth-Conceptions", in the January 1977 *FAA General Aviation News*. The myths pointed out by Mr. Douglas are shared by many pilots and some aviation writers. I only wish that it could be made required reading for every pilot.

Terry T. Lankford
Granada Hills, Calif.

INSTRUMENT CORNER

• ADF but No VOR

Assume the following: (1) A published NDB approach to an airport that has surveillance radar; (2) a missed approach procedure that uses a VOR holding fix, and (3) an aircraft with only an ADF and two-way radio (no VOR receiver). My question: May a legal instrument approach be made, provided ATC is notified of the nav/com equipment status before the approach is initiated? I would appreciate an answer and also a reference to the regulations that apply.

Carl L. Dworman
Evergreen, Colorado

Affirmative. The approach can be made under the conditions you describe. Applicable rule is FAR 91.116 which states in part: "Operation on unpublished routes and use of radar in instrument approach procedures. When radar is approved at certain locations for ATC purposes it may be used not only for surveillance and precision radar approaches, as applicable, but also may be used in conjunction with instrument approach procedures predicated on other types of radio navigational aids."

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